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Thailand

Bio-Fuels

Biofuel's Impact on Food Crops

2009

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Report Highlights:
Biofuel consumption increased significantly in 2008 as petroleum prices reached a record high. The run-up in crude oil prices left gasohol and biodiesel as cheaper options for Thai consumers. Thai government biofuel development objectives put long-term biofuel demand at 13.5 million liters/day, particularly for ethanol. The impact of increased biofuel demand on food crops will be limited as competition for growing area from feed stocks (sugarcane and tapioca) is low.

Includes PSD Changes: No
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Trade Report
Bangkok [TH1]
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Executive Summary

Biofuel consumption increased significantly in 2008 as petroleum prices reached a record high. The run-up in crude oil prices left gasohol and biodiesel as cheaper options for Thai consumers. Attractive prices for E10 (a mixture of 10 percent ethanol and 80 percent premium gasoline) over regular gasoline and the compulsory production of B2 diesel has given Thailand viable alternatives to standard gasoline. Biofuel demand is forecast to increase from 2.1 million liters/day to 13.5 million liters/day, particularly for ethanol. A recent study by the Bank of Thailand found significant correlation between ethanol demand and increases in feedstock prices, particularly for tapioca prices.

However, despite higher feedstock prices, increased biofuel demand should have only a marginal impact on food prices. Currently the commodity most susceptible to increased biofuel demand is palm-based cooking oil. However, the price of palm cooking oil is currently regulated by the Thai Government. Ethanol is produced using sugar and tapioca as feedstock. Longer term, increases in the quantity of tapioca produced is not expected to come at the expense of food crops. All other things being equal, ethanol production will likely remain viable despite anticipated higher feedstock prices, which have been driven by market demand and government intervention programs. Price increases for tapioca should drive yield improvements and acreage expansion in the long run. Domestic demand for feed corn, often grown in the same areas as tapioca, will likely be met by low-cost imported corn from neighboring countries. Increased demand for biodiesel should drive acreage expansion for oil palm through orchard replacement. The impact of orchard replacement will lead to a greater affect on prices as oil palm prices are expected to become more volatile once the B5 diesel production policy is fully implemented and must compete with cooking oil production.

1. Biofuel demand and supply structure

1.1 Biofuel consumption: Up significantly but still far below potential

Increased demand for gasohol and biodiesel drove biofuel consumption in 2008 and accounted for approximately half of total fuel demand. Gasohol consumption (a mixture of ethanol and regular gasoline) increased to 9.3 million liters/day, compared to 4.8 million liters/day in 2007. The increase reflects attractive prices of E10 (a mixture of 10 percent ethanol and 90 percent premium gasoline) over regular gasoline, which sold 8-9 baht/liters (25 cents) lower than regular gasoline. E10 currently benefits from an excise tax reduction implemented in the 2008 government stimulus package. Also, the introduction of E20 gasohol vehicles early in 2008 boosted gasohol consumption as E20 gasohol retailed lower than E10 by 2 baht/liters (6 cents).

Meanwhile, biodiesel consumption reached 57.5 million liters/day, as compared to 6.5 million liters/day due to mandatory B2 biodiesel production (high-speed diesel with the two percent of B100 content by weight) since February 2008.

Table: Thailand's Petroleum Consumption (Unit: Million Liters)

Type	2003	2004	2005	2006	2007	2008	% change 2007	% change 2008
Gasoline								
Regular (octane 91)	4,550	4,631	4,332	4,464	4,467	3,388	0.1	-24.2
Premium (octane 95)	3,082	2,969	2,240	1,471	1,106	341	-24.8	-69.2
Gasohol								
Gasohol E10 Octane 91	-	0	29	94	244	924	158.5	278.1
Gasohol E10 Octane 95	-	14	646	1,185	1,519	2,439	28.2	60.6
Gasohol E20	-	-	-	-	-	29		
Gasohol E85	-	-	-	-	-	0		
High Speed Diesel	17,449	19,517	19,341	18,213	18,046	13,572	-0.9	-24.8
Biodiesel B5	-	0	5	43	627	3,780	1360.9	502.4

Source: Energy Policy and Planning Office, Ministry of Energy

1.2 Biofuel production

The increase in biofuel consumption drove production of ethanol and palm oil. Presently, ethanol production increased significantly to 0.9 million liters/day in 2008, as compared to 0.5 million liters/day in the previous year. Meanwhile, B100 biodiesel production increased to 1.6 million liters/day after implementation of a compulsory B2 biodiesel production and voluntary B5 biodiesel production program initiated by the Thai Government.

1.2.1 Ethanol production

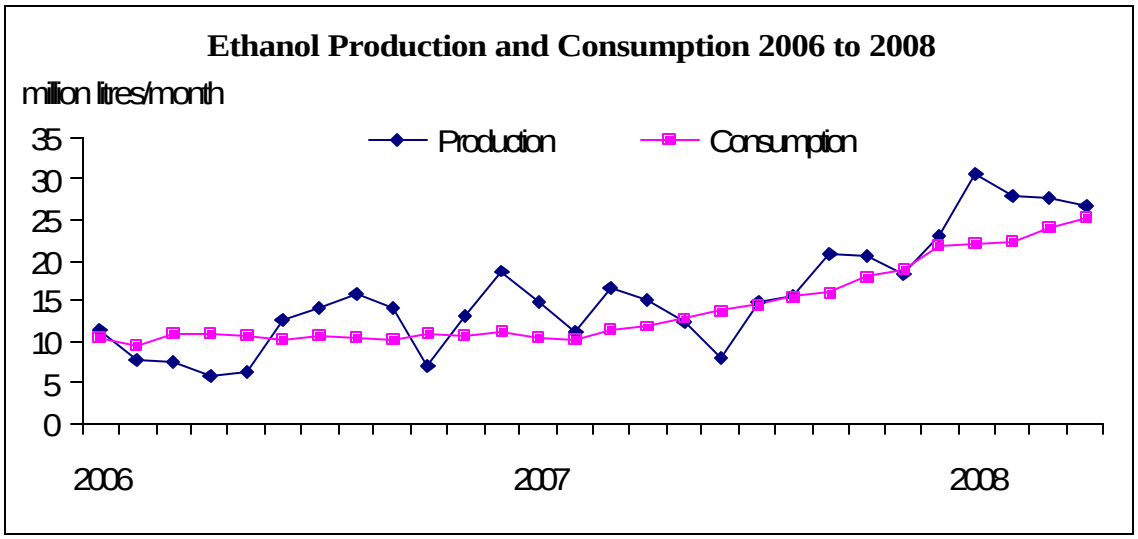
- Ethanol plants

Presently, the Government has granted 47 licenses for ethanol production companies with combined production capacity of around 12.3 million liters/day. However, only nine plants are online with total production capacity at 1.6 million liters/day, of which 8 plants are molasses-based ethanol plants with a combined capacity of 1.4 million liters/day. There is only one tapioca-based ethanol plant with production capacity of 130,000 liters/day. Currently all plants are running at 60 percent of total capacity as Thailand currently holds an ethanol surplus. This

surplus is a major concern for 12 new plants under construction, most of which are tapioca-based ethanol plants. Ethanol investors originally believed the Thai Government would aggressively promote ethanol use, possibly making it compulsory. Although demand for ethanol has been growing, investment expectations exceeded the market situation. It will be some time before domestic gasohol demand meets existing ethanol production capacity. At the moment, surplus ethanol is exported, amounting to 31 million liters in 2008, up significantly from 14 million liters in 2007.

Table: Number of Ethanol Plants and Status

	No. of Plants	Capacity (liters/day)	Tapioca (T)	Molasses (M)	Sugar Cane (S)	M+S	M+T	M+S+T	T+S
On operation plants	11	1,575,000	1	4	0	6	0	0	0
Under construction plants	12	2,600,000	9	0	1	0	2	0	0
Registered plants	31	8,120,000	18	1	0	6	3	2	1
Total number of plants	**54**		**28**	**5**	**1**	**12**	**5**	**2**	**1**
Total Production Capacity (liter/day)		**12,295,000**	**8,390,000**	**675,000**	**200,000**	**1,810,000**	**770,000**	**250,000**	**200,000**



- Ethanol production costs

Ethanol production costs are at around 17-18 baht/liter (50 cents), half of which are raw material costs. Molasses-based ethanol is cheaper than tapioca-based ethanol by 5 percent due to lower variable costs. Despite a recent sharp reduction in tapioca prices, tapioca-based ethanol production costs will likely remain high as the government has implemented an intervention program which set intervention prices higher than market prices by approximately 20 percent (TH9029). Thailand's ethanol production costs are more than double Brazil's sugarcane-based ethanol, and nearly double the cost of U.S. corn-based ethanol.

Table: Costs of Molasses- and Tapioca-based Ethanol Production

	Molasses	Tapioca
Feedstocks (kg.)	1,000	1,000
Ethanol equivalent (liter)	60	180
Conversion (kg./1 liter of ethanol)	3.8	5.6
Avg. prices of feedstocks (baht/kg.)	2.4	1.7
Feedstock cost (baht/liter)	9.1	9.5
Operating cost (baht/liter)	6	7
Margin (baht/liter)	1	1
Total varialble cost (baht/liter)	16.1	17.5
Total fixed Cost (baht/liter)	1.4	0.9
Total cost (baht/liter)	17.5	18.4

Soruce: Bank of Thailand

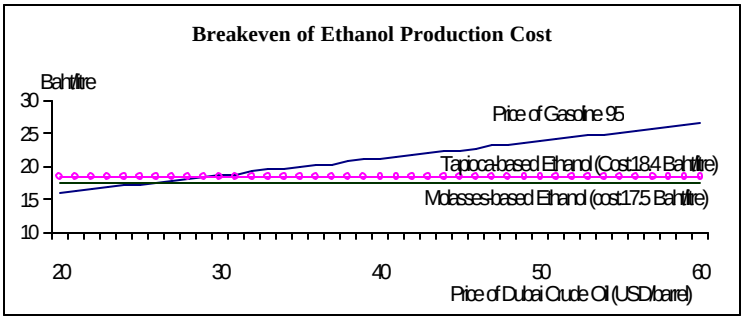
Table: Ethanol Production Cost of Various Countries

Feedstocks	Production Cost (USD per liter)
Molasses: Thailand	0.57
Tapioca : Thailand	0.59
Sugar Cane: Brazil	0.23-0.29
Corn : USA	0.4
Wheat : Europe	0.59
Beatroot: Europe	0.76

Note: Exchange rate 32 Baht / 1 USD

Source : Bank of Thailand and IMF

According to a recent study conducted by the Bank of Thailand study (Bank of Thailand, 2009) on determining the breakeven point of ethanol production compared to 95 octane gasoline, the 17.5 baht/liter ($50 cents/liter) production cost of molasses-based ethanol with will reach a breakeven point at Dubai crude oil prices of approximately $25/barrel. Meanwhile, the breakeven point of tapioca-based ethanol (with production cost of 18.4 baht/liter ($54 cents/liter)) is at Dubai crude oil prices of $29/barrel. Therefore, current ethanol production remains cost effective despite a decline in crude oil prices to around $40/barrel, as compared to over $100/barrel in the previous year.



The Bank of Thailand study also shows that raw material account for more than half of total ethanol production cost. Ethanol plants bear high risk due to feedstock price volatility. Ethanol costs varied from 17 to 26 baht/liter (48 to 78 cents) in the previous year. The price difference between gasohol and 95-octane regular gasoline will be greater if regular gasoline prices increase, and the mixture of ethanol in regular gasoline is higher, especially for E85.

Table: Gasohol price based on Gasoline Octane 95 price at 40 and 50 Baht/liter

Ethanol Price (Baht/liter)	Gasoline Octane 95					
	40 Baht/liter			50 Baht/liter		
	E10	E20	E85	E10	E20	E85
17	37.7	35.4	20.5	46.7	43.4	22.0
18	37.8	35.6	21.3	46.8	43.6	22.8
19	37.9	35.8	22.2	46.9	43.8	23.7
20	38.0	36.0	23.0	47.0	44.0	24.5
21	38.1	36.2	23.9	47.1	44.2	25.4
22	38.2	36.4	24.7	47.2	44.4	26.2
23	38.3	36.6	25.6	47.3	44.6	27.1
24	38.4	36.8	26.4	47.4	44.8	27.9
25	38.5	37.0	27.3	47.5	45.0	28.8

Source : Bank of Thailand

1.2.2 Biodiesel production

Table: Thailand's B100 biodiesel manufacturers

Plant	Production Capaciy (liters/day)
BangChak Petroleum Plc.	50,000
Bio Energy Plus Co.,Ltd.	100,000
Sun Tech Palm Oil Co.,Ltd.	200,000
Pathum Vegetable Oil Co.,Ltd.	300,000
Bangkok Alternative Energy Co.,Ltd.	200,000
Green Power Corporation Co.,Ltd.	200,000
A I Energy Co.,Ltd.	250,000
WeeraSuwan Co.,Ltd.	200,000
Thai Oleo	650,000
Total	**2,185,000**

Presently, nine B100 biodiesel plants are operating at half of their production capacity of 2.19 million liters/day. Although current government policy on mandatory B2 production warrants sale quantities and prices to manufacturers, producers are still concerned that crude palm oil (CPO) production could be a bottleneck for expansion. Expansion of oil palm plantation to meet demand has been limited. The costs of oil palm accounts for around 70-80 percent of total biodiesel production cost.

2. Biofuels crops structure

Current biofuel production is based on sugarcane/molasses and tapioca for ethanol production, and oil palm for biodiesel production. Over the medium term tapioca will be a dominant source of raw materials for ethanol production, as well as oil palm for biodiesel production.

2.1 Sugarcane/Molasses

Presently, sugarcane plantings are around 6-7 million rai (roughly 0.9 - 1.1 million hectares) with production of around 73 million ton of sugarcane. Sugarcane is used in sugar production as sugarcane-based ethanol production remains marginal, as compared to molasses. Annual sugar production is around 7-8 million tons with molasses production at 3-4 million tons, half of which goes for ethanol production. Current molasses supplies are sufficient for molasses-based ethanol production which reaches 60-70 percent of total current production capacities of 1.4 million liters/day. The average extraction rate of molasses for ethanol is 3.8 kg/liter of ethanol.

In MY 2008/09, despite an acreage reduction to 6.4 million rai (1.0 million hectares), sugarcane production is expected to increase to 74.0 million tons with anticipated sugar production reaching 7.9 million tons and molasses production of 3.4 million tons due to yield improvements and favorable weather conditions. Meanwhile, the acreage reduction was due to more attractive returns from tapioca, nearly triple when compared to sugarcane.

Table: Estimated Demand and Supply of molasses for Ethanol Production
unit: million ton/annum

	2009	2010	2011
Beginning stock	0.4	0.3	0.2
Sugarcane production	74.0	76.0	83.0
Molasses production	3.4	3.5	3.9
Supply of molasses	3.8	3.8	4.1
Domestic consumption	1.9	1.9	1.9
Brewing and liquor industries	1.0	1.0	1.0
Feed/seasoning industries	0.4	0.4	0.4
Export	0.5	0.5	0.5
Balance for ethanol production	1.9	1.9	2.2

Source: Office of Agricultural Economic

The Government is supporting sugarcane for ethanol production through a three-year development plan (MY2008/09 – 2010/2011) which seeks to increase sugarcane production to 95 million tons by raising average yields to 15 tons/rai (94 tons/hectare), as compared to yields of 11.8 tons/rai (74 tons/hectare). The increase in sugarcane production will be primarily for ethanol production, which is targeted at 3.4 billion liters/year in MY2010/2011. Meanwhile, sugar production will decline to 5.6 million tons from the current level of 7.6 million tons.

Table: 3-Year Sugarcane Plan (MY 2008/09 - 2010/2011)

	Target		
	MY 2008/09	**MY 2009/10**	**MY 2010/2011**
Sugarcane (Million Ton)	80	87	95
Yield (Ton/Rai)	13	14	15
Planted Area (Million Rai)	6.2	6.2	6.2
Cane for Domestic Sugar Consumption	20	20	20
Cane for Sugar Exports	42	37	32
Cane for Ethanol Production	18	30	43
Sugar			
Sugar Yield (kg.)/Ton of Cane	107	107	108
Sugar Production (Million Ton)	6.60	6.10	5.62
Sugarcane-based Ethanol Production (Million Liter/Year)	1,400	2,400	3,440
(Million Liter/Day)	3.8	6.6	9.4

Source: Ministry of Industry

2.2 Tapioca

Tapioca cultivation is approximately 7-8 million rai (roughly 1.1 – 1.3 million hectares) with annual production of 25-30 million tons. Tapioca product exports, including flour, chip, and pellet, account for 70 percent of total production. Presently, there is only one tapioca-based ethanol plant with production capacity of 130,000 liters/day. The average extraction rate of tapioca for ethanol is 5.6 kg./liter of ethanol.

In MY 2008/09 tapioca production is forecast to increase to a record 29 million tons reflecting strong export demand for tapioca products, particularly for tapioca flour and tapioca chips, in the previous year. Also, yields are expected to increase to 3.6 tons/rai. Meanwhile, the single tapioca-based ethanol plant currently utilizes approximately 0.2 million tons tapioca. At present, the Government has implemented an intervention program which set intervention prices higher than market prices (TH9029).

Table: Estimated Demand and Supply of Tapioca for Ethanol Production

unit: million ton/annum

	2009	2010	2011
Beginning stock	0.4	2.0	4.3
Tapioca production	30	34	34
Supply of tapioca	30.4	36.0	38.3
Domestic consumption	7.9	7.9	8.2
Tapioca pallets/chips	2.6	2.6	2.6
Tapioca flour	5.3	5.3	5.6
Exports	20.2	21.4	21.4
Tapioca pallets	2.1	2.1	2.1
Tapioca chips	8.0	8.6	8.6
Tapioca flour	10.1	10.7	10.7
Balance for ethanol production	2.3	6.7	8.6

Source: Office of Agricultural Economic

2.3 Oil palm

Oil palm plantation has increased to around 3.0 million rai (480,000 hectares) over the past three years with fresh palm fruit production of 6-7 million tons (roughly 1.2 million tons of crude palm oil, CPO). The mandatory production of B2 biodiesel contributed significantly to the acreage increase in 2009. Planted areas are expected to increase an additional 326,675 rai (52,268 hectares). However, this increase is approximately 35 percent below the annual target of 80,000 hectares. In response to palm promotion, palm ranchers have begun growing palm in new areas including the North, Northeast, East and South regions of Thailand by replacing old orchards.

Table: Demand for biodiesel and feedstocks

unit: million liters/day

	2008	2009	2010	2011	2012
Demand for diesel	55.6	57.3	58.7	60.3	62.7
Demand for biodiesel (B100)	1.35	1.35	1.35	3.07	3.08
B100 for B2 production	0.92	0.92	0.92	0	0
B100 for B5 production	0.43	0.43	0.43	3.01	3.01
B100	0	0	0	0.06	0.07
Demand for feedstocks (palm oil: MMT)	0.48	0.48	0.48	1.04	1.08
Crude Palm Oil (CPO)	0.35	0.35	0.35	0.84	0.87
Sterin	0.11	0.11	0.11	0.2	0.21
Oil palm production plan (MMT)*					
Fresh Palm Fruit	8.44	9.18	10.17	12.06	16.56
CPO	1.48	1.65	1.83	2.23	2.51
Domestic demand (MMT)					
non-fuel use	0.92	0.98	1.05	1.13	1.21
balance for biofuel production	0.56	0.67	0.78	1.1	1.3

Note * Acreage expansion of oil palm plantation target at 2.5 million rai (0.4 million hecrtares) and replantation of 0.5 million rai (0.08 hectares)

Source: Ministry of Energy

Realizing that Thailand needs to increase palm oil production to meet demand, the Ministry of Agriculture and Cooperatives and the Ministry of Energy ford a joint "Committee on Biofuel Development and Promotion" (CBDP), which plans to expand palm production by 2.5 million rai

(0.4 million hectares) through orchard replacement. In addition, the committee plans to increase fresh palm productivity from 19 tons/hectare to 22 tons/hectare, and increase the crushing rate of crude palm oil from 17 percent to 18.5 percent by 2012. To achieve the goals, the RTG will provide low-interest loans to participating oil palm farmers. In addition, the government plans to push compulsory biodiesel production from B2 to B5 across the country by 2011 (TH8083). Based on estimated diesel demand of 22,860 million liters in 2012, mandatory B5 use could generate demand of 1.08 million tons of crude palm oil and sterin for biodiesel production.

3. Impact of Biofuel consumption on Food Crops

Anticipated increases in biofuel consumption over the medium term will boost demand for biofuel inputs, particularly sugar/molasses and tapioca for ethanol, and oil palm for biodiesel. According to the government's 15-year biofuel development plan (2008 – 2022), biofuel demand will increase from current levels of 2.1 million liters/day to 13.5 million liters/day. Ethanol demand is expected to increase significantly from current levels of 0.9 million liters/day to 9.0 million liters/day.

Table: 15-year Biofuel Development Plan

unit: million liters/day

	2008	2009 - 2011	2012 - 2016	2017 - 2022
Ethanol	0.88	3.00	6.20	9.00
Biodiesel	1.22	3.00	3.64	4.50
Total	**2.10**	**6.00**	**9.84**	**13.50**

Source: Ministry of Energy

3.1 Food crop impact from ethanol demand

Ethanol consumption will increase over the medium through increased use of E20 and E85 gasohol. Demand for gasoline could shift to E85, driving demand to 17.0 million liters/day (6,205 million liters annually). In order to reach such E85 volume without affecting other sugarcane and cassava-based industries, sugar cane production is forecast to increase to 158.2 million tons from current production of around 73 million tons, or tapioca production to increase to around 50 million tons from 28 million tons.

The Bank of Thailand study found significant correlation between ethanol demand and increases in feedstock prices, particularly for tapioca prices. Meanwhile, changes in sugarcane prices are insignificant due to the domestic support program (TH8152). Also, the study indicated that the current tapioca price increase should result in greater yield improvements in the long run. Producers expect the average yield of tapioca can double from current average yield of 3.7 ton/rai.

Table: Estimated Planted Area and Average Yield per Rai of Tapioca

Scenairo	Planted Area (million rai) yield: 3.7 tons/rai	Yield per rai (tons per rai) plantation area: 7.6 million rai
- Baseline	7.6	3.7
- E85	15.2	7.5
- E100	16.8	8.3

Source : Bank of Thailand

In the short-term, tapioca-based ethanol plants should remain cost effective despite the government intervention program. Tapioca feedstock demand will largely be met through yield improvements, which are expected to double through improved farming practices. Meanwhile, acreage increases are expected at the expense of corn production because of the similarity in growing condition. However, domestic demand for feed corn will be met by imported corn from neighboring countries, particularly from Laos, and Cambodia, under the Joint Economic Cooperation Strategy Program, or Ayeyawady-Chao Praya-Mekong Economic Cooperation Strategy (ACMECS).

3.2 Food crop impact from biodiesel demand

The government's plan to push compulsory biodiesel production from B2 to B5 across the countries by 2011 will have a significant impact on demand for domestic oil palm, the only raw material for B100 biodiesel production at the moment. It is estimated that demand for crude palm oil and stearin (palm oil by-product) will increase to 3.1 million liters/day, as compared to current levels of approximately 1.2 million liters/day.

Increasing demand for crude palm oil has affected domestic prices for fresh palm fruit. Producers have responded by expanding production of oil palm acreage. Production of crude palm oil (CPO) in 2009 is estimated to increase from 1.04 million tons in 2008 to 1.16 million tons due mainly to increased harvested area. Domestic prices for fresh palm fruit have increased from approximately $70/ton to $128/ton in the past two years. For the next several years, oil palm acreage expansion will occur through orchard replacement in the north, northeast, and the east. The impact on food crops will be marginal. However, oil palm prices will likely be more volatile when the B5 diesel production policy is fully implemented, as oil palm production is sensitive to weather conditions and oil palm utilization for B5 will compete more heavily with cooking oil.

End of report.